polymeric membrane.

13. (amended) A fuel cell comprising a proton conducting polymeric membrane made by a method comprising

dissolving a polymer in an organic solvent to form a polymer solution;

adding an oxyacid to the polymer solution;

casting the oxyacid-containing polymer solution onto a casting surface; and

removing the organic solvent slowly so as to form a uniform proton conducting polymeric membrane.

## Remarks

Amendments to the Claims

Claims 1-13 are pending. Claim 11 was allowed. Claims 5 and 8 were objected. Claims 1-4, 6-7, 9, 10, and 12-13 were rejected. Claims 1, 5, 7, 8, and 12-13 have been amended as discussed below. Support is found at least in the original claims and at p. 6, lines 9-14.

The applicants appreciate the allowance of claim 11 and the Examiner's holding that claims 5 and 8 are allowable if rewritten in the form of independent claims.

Rejection Under 35 U.S.C. § 102

Claims 1, 3, 4, 6, 7, 10, and 12-13 were rejected under 35 U.S.C. § 102(e) as anticipated by U.S. Patent No. 6,248,469 to Formato et al. ("Formato"). Applicants respectfully traverse this rejection to the extent that it is applied to the claims as amended.

*Formato*

Formato describes a method of making solid polymer electrolyte membranes (SPEMs) which include a porous polymer substrate interpenetrated with an ion-conducting material (col.

5, lines 62-64; col. 9, line 55 to col. 10, line 43). The polymer substrate is a porous polymer having a pore size in the range of 10 Å to 2000 Å (col. 6, lines 25-50; col. 10, lines 6-8). The ion-conducting material is a sulfonated, phosphonated or carboxylated aromatic polymer or carboxylic, phosphonic or sulfonic acid substituted non-aromatic polymer such as perfluorinated vinyl ethers (col. 7, lines 10-28; col. 14, lines 9-41). The solvents for the preparation of the SPEMs are usually organic solvents, but may also include sulfuric acid, phosphoric acid, chlorosulfonic acid, polyphosphoric acid, and methanesulfonic acid (col. 8, lines 18-25; Examples 1 and 4).

*The claimed invention*

The claimed subject matter, however, specifically requires (1) dissolving a polymer in an organic solvent to form a polymer solution; (b) adding an oxyacid to the polymer solution; (c) casting the oxyacid-containing polymer solution onto a casting surface; and (d) removing the organic solvent so as to form a proton conducting polymeric membrane. Therefore, the claimed subject matter requires (1) a polymer, (2) an organic solvent, and (3) an oxyacid.

Formato is different from the claimed subject matter in at least three aspects. First, Formato does not require an oxyacid as a compositional ingredient of the polymer as does the claimed subject matter. To the extent that Formato is relevant, Formato uses sulfuric acid, phosphoric acid, chlorosulfonic acid, polyphosphoric aicd, or methanesulfonic acid as one of the usable solvents, **which is to be removed** from the SPEMs (col. 35, lines 26-28; col. 37, line 56). Particularly, Formato requires the **acidic material be washed away** (col. 33, lines 3-6) or **neutralized by a base** (col. 32, lines 44-46).

Secondly, Formato requires a **porous** polymer substrate interpenetrated with an ion-conducting material. In contrast, the claimed subject matter forms a uniform proton conducting membrane. As described in the specification, the claimed subject matter requires the step of removing the organic solvent to be controlled at a sufficiently slow rate to **minimize the formation of pores** in the membrane (p. 6, lines 9-14).

Thirdly, the SPEMs described in Formato were made by a process which the solvent is rinsed out or washed away by water (col. 31, lines 20-23 and 26-29) in a water bath. In contrast, the claimed method or membrane requires the solvent to be slowly removed, i.e., by evaporation. Therefore, Formato does not describe slow removal of the solvent as required in the claims.

There, Formato cannot anticipate claims 1, 3, 4, 6, 7, 10, and 12-13 under 35 U.S.C. § 102(e).

Rejection Under 35 U.S.C. § 103

Claims 2 and 9 were rejected under 35 U.S.C. § 103 as obvious over Formato. The applicants respectfully disagree if the rejection is applied to the claims as amended.

First, as discussed above, Formato does not describe an oxyacid as the compositional ingredient of the film. Therefore, Formato failed to disclose each and every element of the claimed method and film. Second, Formato does not provide motivation for one of ordinary skill in the art to incorporate an oxyacid defined therein into the claimed membrane. In contrast, Formato teaches rinse out, wash away or neutralize the acidic residue when an acid such as sulfuric acid is used as solvent in the process of making the film forming polymer. Thirdly, even

if Formato provided motivation for one to make and use the method and membrane defined in the claims, Formato still requires the polymer to be porous, an attribute that claims 2 and 9 sought to minimize. Therefore, one of ordinary skill in the art in possession of Formato cannot have a reasonable expectation of success. As such, Formato does not make claims 2 and 9 *prima facie* obvious.

Moreover, Formato teaches away from claims 2 and 9. Contrary to the claimed method, Formato teaches washing away or neutralizing the acidic residues from the film forming polymer; using porous polymer substrates; and removing the film-casting solvent quickly by rinsing out and washing away the solvent in a water-bath. Therefore, Formato teaches away from claims 2 and 9 and other claims, as amended, rebutting any asserted prima facie obviousness of claims 2 and 9, or any other claims. As such, claims 2 and 9 and any other claims, are not obvious under 35 U.S.C. § 103 over Formato.

Objection to claims 5 and 8

Claims 5 and 8 were objected to as depending on rejected claim 1. Claim 5 has been re-written as an independent claim. Claim 8 has been re-written as dependent on claim 5.

## Marked Up Version of Amended Claims
## Pursuant to 37 C.F.R. § 1.121(c)(1)(ii)

1. (amended) A method for making a proton conducting polymeric membrane, comprising

dissolving a polymer in an organic solvent to form a polymer solution;

adding an oxyacid to the polymer solution;

casting the oxyacid-containing polymer solution onto a casting surface; and

removing the organic solvent slowly so as to form a uniform proton conducting polymeric membrane.

2. The method of claim 1 further comprising adding water to the oxyacid-containing polymer solution in a molar ratio equivalent to the oxyacid.

3. The method of claim 1 further comprising concentrating the oxyacid-containing polymer solution prior to casting the oxyacid-containing polymer solution onto the casting surface.

4. The method of claim 1 wherein the polymer is selected from polyphosphazenes, polyalkenes, polyacrylics, polyvinyl ethers, polyvinylhalides, polystyrenes, polyesters, polyurethanes, and polyamides.

5. A [The]method [of claim 4] for making a proton conducting polymeric membrane, comprising

dissolving a polymer in an organic solvent to form a polymer solution;

adding an oxyacid to the polymer solution;

casting the oxyacid-containing polymer solution onto a casting surface; and

removing the organic solvent so as to form a proton conducting polymeric membrane,

wherein the polymer is a polyphosphazene.

6. The method of claim 1 wherein the organic solvent is tetrahydrofuran.

7. The method of claim 1 wherein the oxyacid is selected from boric, carbonic, cyanic, isocyanic, silicic, nitric, nitrous, phosphoric, phosphorous, hypophosphorous, arsenic, arsenious, antimonic, sulfuric, sulfurous, selenic, selenious, telluric, chromic, dichromic, perchloric, chloric, chlorous, hypochlorous, bromic, bromous, hypobromous, periodic, iodic, hypoiodous, permanganic, manganic, pertechnetic, technetic, perrhennic, rehnnic acids, and their condensation products.

8. (amended) The method of claim [1] 5 wherein the oxyacid is phosphorous oxychloride.

9. The method of claim 1 wherein the casting surface is formed of or coated with polytetrafluoroethylene.

10. The method of claim 1 wherein the organic solvent is removed by evaporation.

11. A proton conducting polymeric membrane comprising a mixture of a polyphosphazene and an oxyacid.

12. (amended) A proton conducting polymeric membrane made by a method comprising

dissolving a polymer in an organic solvent to form a polymer solution;

adding an oxyacid to the polymer solution;

casting the oxyacid-containing polymer solution onto a casting surface; and

removing the organic solvent slowly so as to form a uniform proton conducting polymeric membrane.

13. (amended) A fuel cell comprising a proton conducting polymeric membrane made by a method comprising

dissolving a polymer in an organic solvent to form a polymer solution;

adding an oxyacid to the polymer solution;

casting the oxyacid-containing polymer solution onto a casting surface; and

removing the organic solvent slowly so as to form a uniform proton conducting polymeric membrane.